

Welcome to <http://hou.lbl.gov/~whoette/Explorations/Apogee-Perigee/index.html>



**Hands-On Universe™**  
**Explorations**



**Apogee-Perigee**

[Link to apogee-perigee images in .fts format.](#)

**Apogee - Moon far from Earth**

**Perigee - Moon close to Earth**

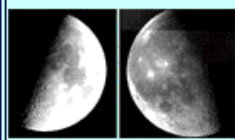
The orbit of the moon is not circular. Sometimes the Moon is closer to Earth and sometimes farther from Earth. Make a Prediction! What will be different about the apparent size of the Moon at apogee as compared to perigee?


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Explain your thinking....

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To investigate this phenomena, HOU teacher, Fred Page requested images in January 2003 of the moon near apogee and near perigee. We made mosaics to show the composite images for each date.



1.  Open HOU-IP software.
2. Open image moon-near-apogee030111.fts and image moon-near-perigee030124.fts
3. Flip one of the images horizontally. (Manipulation, Flip, Horizontally)
4. Add the apogee and perigee images together. (Manipulation, Add, Displayed Image. Select other image. Save result in a new window. OK.)

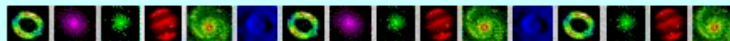
Was your prediction correct? \_\_\_\_\_ What is your evidence?

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Could you calculate the percent change? Hint: Look in Data Tools, Image Info, keyword DISTANCE.

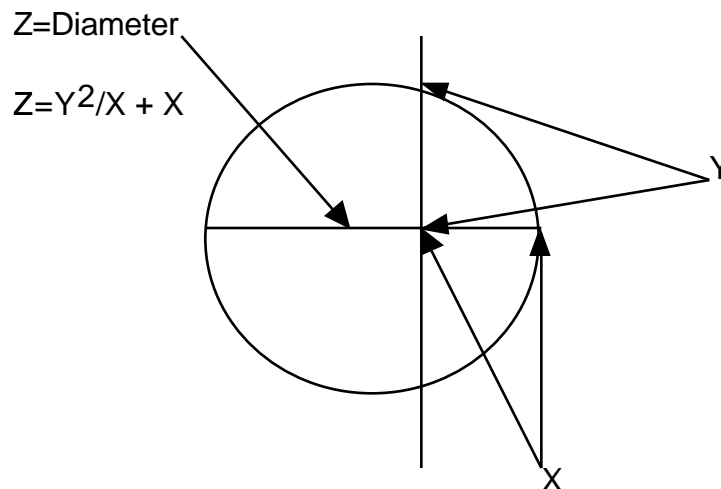
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[Compare side by side pictures of apogee and perigee.](#)

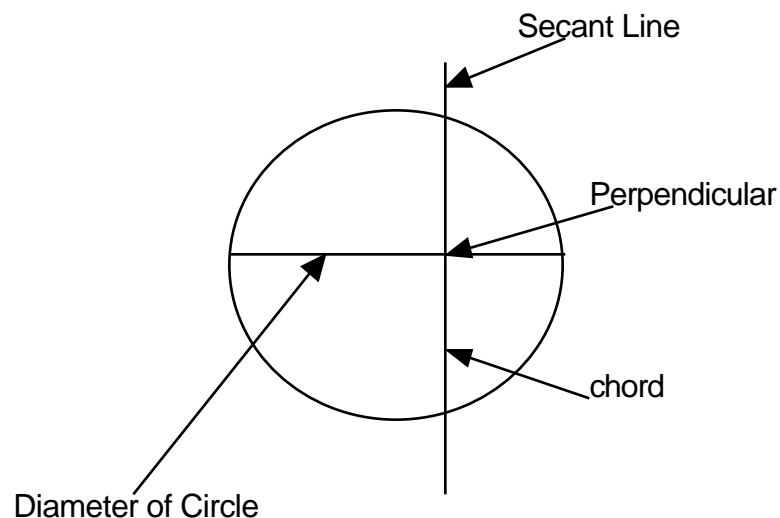


01/24/2003

Geometry: Fact One: If 2 intersecting chords are drawn in a circle, the product of the measures of the 2 parts of one chord will equal the product of the 2 parts of the other chord. (a **chord** is a line inside a circle that connects two different points of the circumference) (a **secant** is a line that passes through a circle and forms a chord inside the circle)



Fact Two: If you draw a perpendicular to a chord at the middle of the chord to the edge of the circle, the new line if extended across the circle pass directly through the middle of the circle and will constitute the diameter of the circle.



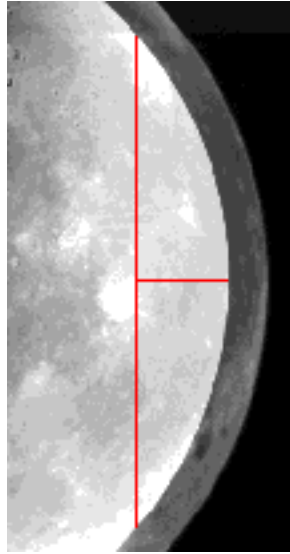


*Window:* The combined lunar image, center the image in the window using the side sliding bars then :

1. Draw a vertical slice (chord) on the inner moon image that passes from the top edge of the image to the bottom edge. Draw as large a slice as you can fit inside the image, keeping the “x” coordinate with the same value as you slice from top to bottom keeping the entire slice visible within the inner moon image.

2. Using the slice graph window, hold the left mouse button and drag the cursor across the slice to determine the exact length in pixels of your slice. Divide this value by 2 to determine the middle of the slice, then locate that exact spot using the same technique you used to measure the length of the slice. As you drag the square to the center and then stop it will remain there. Close the graph slice window.

3. Draw a second slice from the center point of your chord in step #2 that is a perpendicular to this chord out to the edge of the inner moon image. Measure the length of this line using your slice graph.



4. Using the following equation based on the Geometry of Circles,  $Z = Y^2/X + X$ . Determine the Value of the diameter of the inner Moon image.

5. Repeat procedure steps 1/4 using the outer moon image in the combined lunar image window.

Now, examine the two values you calculated for the diameters of the two images that were taken at different days of the month. What do you discover? What can you conclude about the shape of the Moon's orbit around the Earth? Is it circular? Why or why not?

### **Extra Thoughts:**

From your data in step 4. Can you calculate the apparent Moons diameter size change.

Can you calculate the expected % change in apparent image diameter size using the distances to the moon found in the *Image info* under data tools.

How do the two calculated values compare? What might explain any differences. (Hint: sources of experimenal error)

